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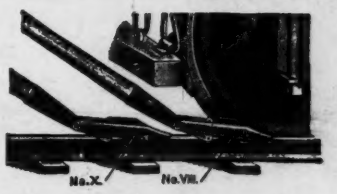

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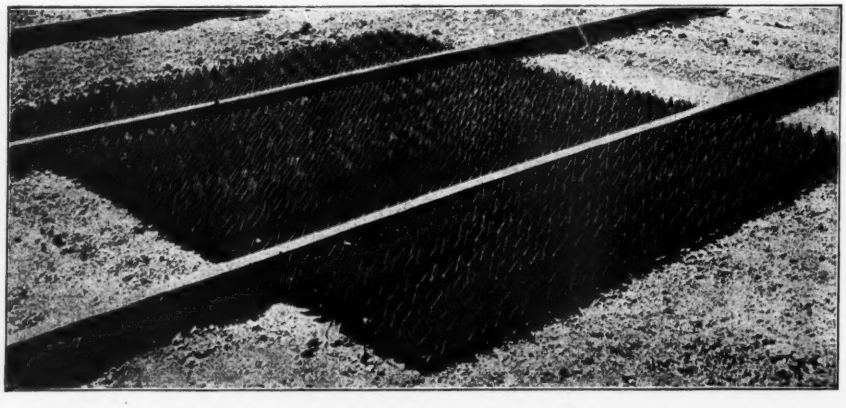

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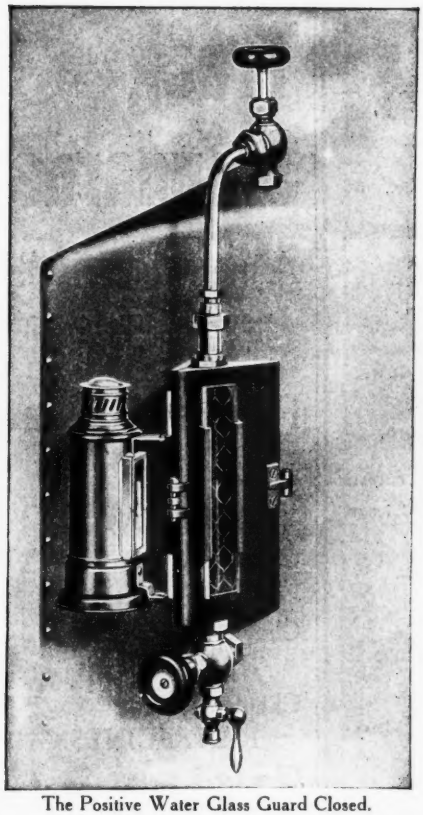

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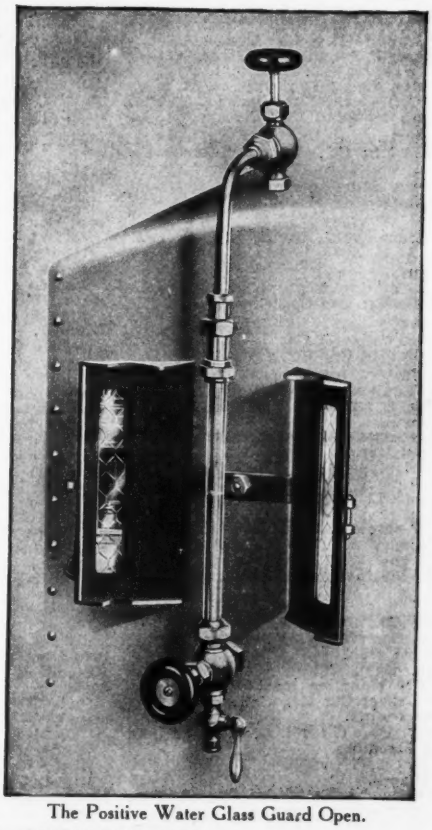

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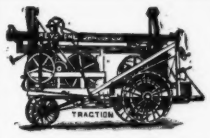

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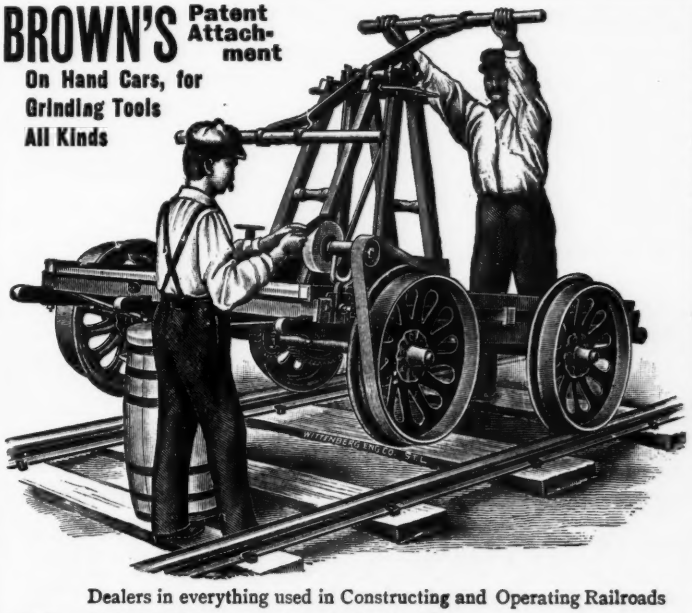

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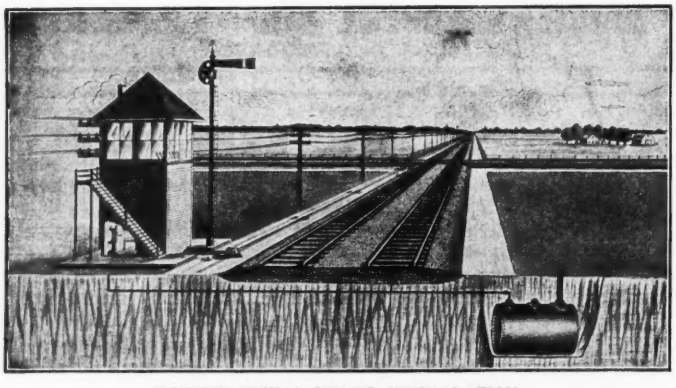

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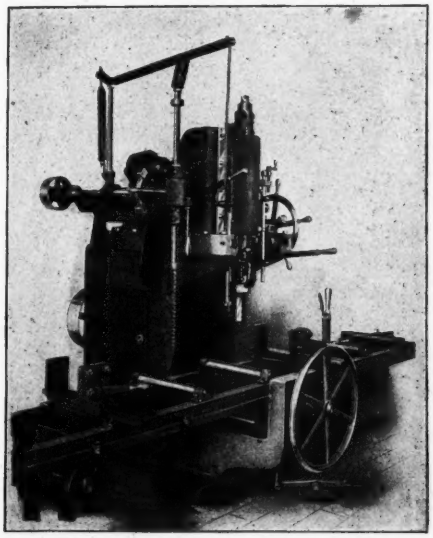
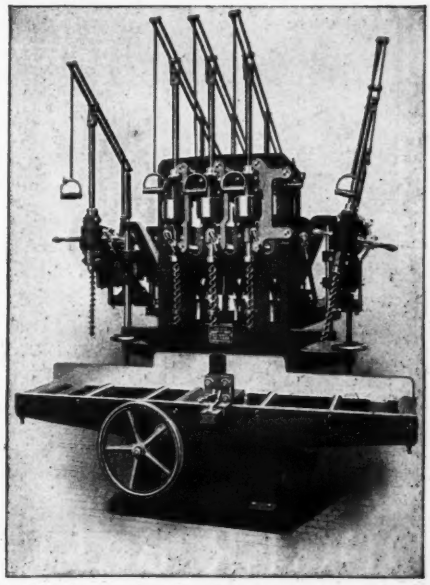
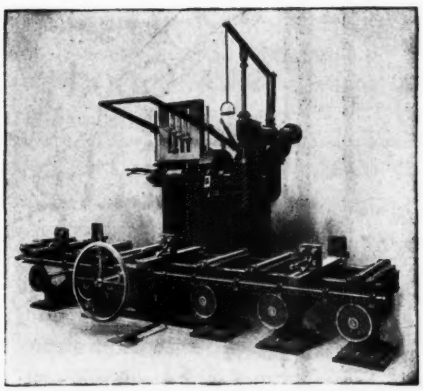


No. 225—Vertical Automatic Hollow Chisel Mortiser.

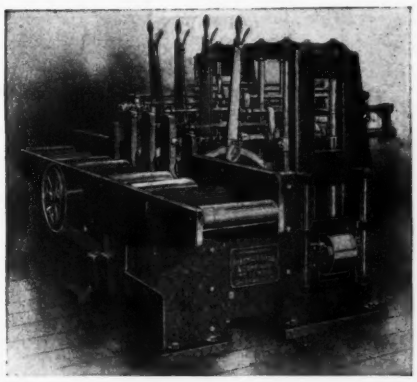
GREENLEE



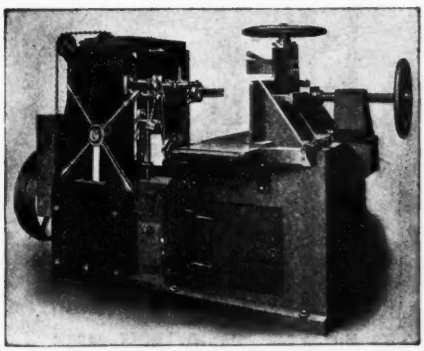
No. 327—Vertical Car Boring Machine with Universal Spindles



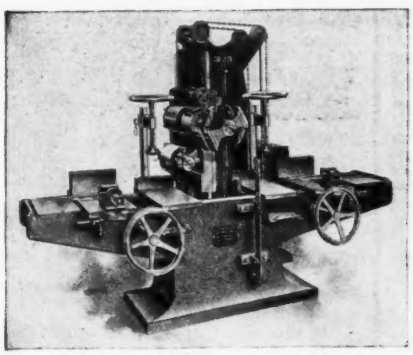
No. 512—Extra Range Automatic Car Gainer with Boring Attachment.



No. 306—Extra Range Horizontal Car Boring Machine.



No. 218—Extra Range Automatic Hollow Chisel Car Mortiser.



No. 525—Vertical Automatic Car Sill Tenoning Machine.

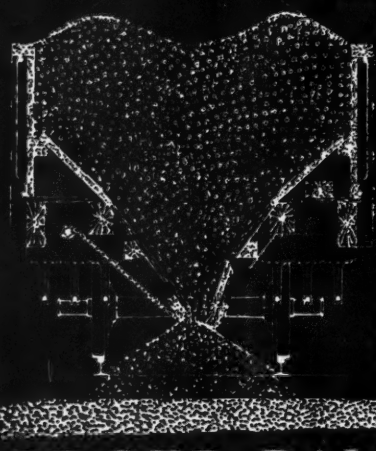
FINEST IN DESIGN AND WORKMANSHIP. FASTEST IN OPERATION

Greenlee Bros. & Co.

ROCKFORD, ILL. CHICAGO, ILL.

RODGER BALLAST HART CONVERTIBLE CAR

THREE CARS IN ONE



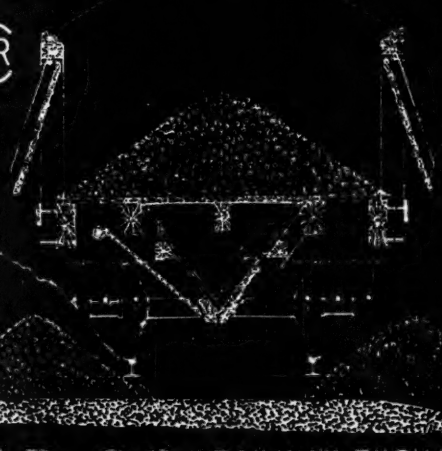
CONSTRUCTION
BALLAST
GENERAL FREIGHT

CAR

BUILT OF 30 TO 60 TONS CAPACITY AND OF EITHER WOOD OR STEEL

CHANGED FROM CENTER DUMP TO SIDE DUMP OR VICE-VERSA IN 20 MINUTES WITHOUT TOOLS

THOUSANDS IN DAILY SERVICE HAVE PROVEN ITS GREAT ECONOMY AND PRACTICABILITY.



RODGER BALLAST CAR CO. RAILWAY EXCHANGE CHICAGO, ILL

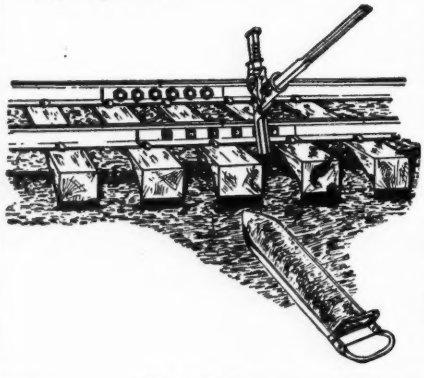
WALTERS'

BALLAST PLACING DEVICE

Patented March 21, 1905

Has been placed in service on eleven trunk lines and eight smaller railroads since April 1st.

FIG. 1—Showing ballast removed from end of ties to be raised, track jacked up and device in position to receive ballast for placing under tie.



We will guarantee that every particle of ballast will remain under tie and that machine will work in any kind of ballast.

Order Samples

Satisfaction guaranteed or money refunded.

References: Any Bank in the City.

FIG. 2—Showing pan removed, ballast under tie, and cleaner ready to be withdrawn.

WALTERS & OKELL

Ft. Madison, Iowa

We Sell Good

Bridge Paint

Send for an attractive collection of half tone engravings showing prominent bridges painted with

Superior Graphite Paint

Detroit Graphite Mfg. Co.,

DETROIT, MICH.

Track Laying by Machinery

Simple—Rapid—Economical

D. F. HOLMAN RAILWAY TRACK LAYER CO.

1105 Ellsworth Bldg, Chicago

Railway Engineering

and Maintenance of Way

Mr. F. O. Hill has been appointed the supervisor of bridges and buildings of the Montpelier & Wells River, with office at Montpelier, Vt.

Mr. T. Kennard Thomson, M. Am. Soc. C. E. and a consulting engineer, with office at 50 Church street, New York, has been retained by the Erie as consulting and supervising engineer for the Penhorn Creek viaduct.

The office of Mr. B. B. Kelliher, chief engineer of the Grand Trunk Pacific, has been moved from Montreal, Que., to Winnipeg, Man. The office of Mr. H. A. Woods, assistant chief engineer, will remain at Montreal.

Mr. M. E. Hamilton has been appointed the general air-brake inspector of the Atchison, Topeka & Santa Fe System, with office at Topeka, Kan. He will have full charge of all matters pertaining to air-brakes and air-brake inspectors.

Mr. J. H. Rollo has been appointed the supervisor of bridges and buildings of the Georgia, Florida & Alabama, with office at Havana, Fla., and Mr. J. A. Anderson has been appointed the roadmaster, with office at Bainbridge, Ga. The office of superintendent of maintenance and construction has been abolished.

Mr. E. L. Sudheimer, master mechanic of the Chicago Great Western, has resigned to go with the Peteler Car Co. of Minneapolis, Minn.

Mr. R. W. Burnett, assistant master car builder of the Canadian Pacific, has been appointed master car builder to succeed Mr. W. E. Fowler, who has resigned on account of ill health.

Mr. J. F. Casey, formerly foreman of the car department of the St. Louis, Brownsville & Mexico, has been appointed to a similar position with the Fort Worth & Rio Grande.

Mr. J. A. Baker, who on March 15 was promoted from general foreman to superintendent of shops of the Vera Cruz al Istmo Ry., was on June 1 promoted to the position of master mechanic of the same line with headquarters at Tierra Blanca, State of Vera Cruz, Mexico.

Mr. W. J. Mellor, superintendent of bridges and buildings of Morgans Louisiana & Texas R. R. and of the Louisiana Western Ry., died recently. He was 48 years old.

Mr. J. P. Snow, formerly bridge engineer of the Boston & Maine, has been appointed chief engineer of that road, to succeed Mr. H. Bissell, who has resigned.

Mr. George S. Gatchell, at one time prominent in public and business life in Buffalo, and for a number of years chief egineer, and later general superintendent of the old Buffalo, New York & Philadelphia, now a part of the Pennsylvania's system, died recently at Canandaigua. He was 62 years old.

Mr. L. Stubbs, resident engineer of the Houston & Texas Central at Ennis, Tex., has resigned to become supervising engineer of the Causeway at Galveston. Mr. E. M. Morsand has been transferred from the second division to succeed Mr. Stubbs and he in turn is succeeded at Houston by Mr. J. C. McVea.

Several important changes have been announced in the engineerig departmet of the Baltimore & Ohio R. R., effective at once. Mr. G. D. Brooke, assistant engineer of the Pittsburg division, with offices in the Water street passenger terminal, has been promoted to engineer of the Baltimore division. He succeeds Mr. W. Trapnell, who has left the service of the Baltimore & Ohio to engage in other business. Mr. C. Johnson, assistant engieer of the Baltimore division, who reported to Division Engineer Trapnell, has been transferred to Pittsburg as assistant division engineer succeeding Mr. Brooke.

Mr. William M. Saxton has been appointed the master mechanic of the North Coast Railroad, with office at Spokane, Wash.

Mr. C. H. Temple, master mechanic of the Central division of the Canadian Pacific, has been appointed assistant superintendent of motive power, with office at Winnipeg, Man.

Mr. M. F. McCarra has been appointed the general foreman of the Kingsville shops of the St. Louis, Brownsville & Mexico, with office at Kingsville, Tex., succeeding Mr. A. J. Conrad, resigned.

Mr. C. Z. Moore has been appointed the supervisor of Division No. 4, of the Philadelphia division of the Eastern Pennsylvania division, of the Pennsylvania, with office at Middletown, Pa., succeeding Mr. R. L. Baird, granted leave of absence.

Mr. F. J. Hemphill, signal supervisor of the Illinois division of the Chicago, Rock Island & Pacific, has been appointed the signal supervisor of the Choctaw and Southern districts, with office at El Reno, Okla., succeeding Mr. J. J. Evans, transferred. Mr. S. Miskelly succeeds Mr. Hemphill, with office at Rock Island, Ill. Mr. A. G. Nutting has been appointed the acting supervisor of the Central district west of Davenport, and of that part of the Des Moines Valley division between Des Moines, Iowa, and Sibley, with office at Des Moines.

Mr. B. D. Lockwood, mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, has resigned to become assistant chief engineer of the Pressed Steel Car Co.

Mr. J. T. Connor, acting superintendent of motive power and machinery of the Houston, East & West Texas and the Houston & Shreveport at Houston, Texas, has been appointed the superintendent of motive power and machinery.

Mr. D. W. Fitzgerald, master mechanic of the Gal-

veston, Harrisburg & San Antonio at El Paso, Tex., has been appointed the assistant general superintendent of motive power of the St. Louis & San Francisco, with office at Springfield, Mo.

Mr. F. W. Hawks, division engineer of the Virginian Railway, has been appointed assistant chief engineer of the Yunnan-Szechua & Teng Yueh Railway of China, and will sail on July 20 with Mr. W. S. Dawley, chief engineer.

Mr. Hugh D. Lumsden, chief engineer of the commissioners of the Trans-Continental Railway, with office at Ottawa, Ont., has tendered his resignation.

Mr. W. H. Petersen, bridge engineer of the Chicago, Rock Island & Pacific, with office at Chicago, has been appointed the principal assistant engineer, with office at Chicago.

Mr. C. F. Richardson has been appointed the assistant to the superintendent of motive power of the Chicago, Rock Island & Pacific, in charge of fuel economy, with headquarters at Chicago.

Mr. Guy Harvey, assistant engineer of the Eastern division of the Toledo & Ohio Central, with office at Bucyrus, Ohio, has been appointed assistant engineer of the Western division, with office at Columbus, Ohio. He is succeeded by Mr. Robert Miller.

Mr. S. S. Stiffey, the general superintendent of motive power of the Toledo & Ohio Central, the Hocking Valley and the Zanesville & Western, has resigned as the general superintendent of motive power of the Hocking Valley.

Mr. H. S. Wall, the master mechanic of the Arizona division, Atchison, Topeka & Santa Fe Coast lines, with office at Needles, Ariz., has been appointed the superintendent of shops at San Bernardino, with jurisdiction over all mechanical department facilities excepting the roundhouse. L. A. Mattimore succeeds Mr. Wall.

Mr. W. E. Ballantine, chief electrician of the Chicago, Rock Island & Pacific, will work in future under the jurisdiction of the mechanical department officials, and subject to their approval, will have charge of car and engine electric lighting and will give such assistance with regard to electric appliances for shop use as may be required. The electric lighting at all points on this road where the current is supplied by mechanical department facilities will be under the direct supervision of the mechanical department. At other points the electric lighting will be under the supervision of the superintendent of telegraph.

Mr. D. K. Ingen, assistant district engineer of the New York Central & Hudson River at Syracuse, N. Y., has had his office moved to Corning, N. Y., and will be in charge of the territory of the Pittsburg division. Mr. H. L. Preston, assistant engineer at Syracuse, is appointed assistant district engineer, with office at Syracuse.

The Maintenance of Way Department

Track Drainage

Editor, Railway Engineering:

We cannot maintain good track anywhere unless properly drained. Locations and conditions are quite different on a great many railroads. In Florida we endeavor to have our ditches all cleaned out by the 15th of November on account of the heavy rains during the winter season.

Where we have sand cuts there should be one to one slope on the back of the ditch; back of ditch to be 15 feet from nearest rail, the shoulder of the berm line to be 42 inches from the outside rail; one to one slope from berm line to back side of ditch.

In clay cuts, half a slope to the back of the ditch will do, but should be on the same line as the sand cuts measuring away from the track.

Yours truly,

Florida. Roadmaster.

Gauging Track

Editor, Railway Engineering:

Track should be put in perfect gauge when new ties are being put in, otherwise it will cause these ties to be respiked later, and if from three to four ties are put in each rail length each year (which is the system that should be followed) the track will be at all times in good gauge. When laying new rail, it should be laid to gauge also. I prefer winter months to do gauging, when I find it necessary to do gauging other than the above. I realize that in the far north this is hard to do, but when it can be done winter is the best time, as other work is out of the way.

All spike holes should be plugged, and where possible, spike should be driven in the plug, or in front or behind it, as the change in gauge may require, and not to one side, thus cutting new fibers in the tie, as this would shorten the life of the tie, and the timber, being compressed where plug is put in, gives the spike a firmer hold. The gauge should be placed on every second tie, unless gauging on very light rail, where it should be placed on every tie. Where more than one gauge is used in a gang, care should be taken to see that both gauges are alike, as a very slight difference in gauges makes a bad looking piece of track.

The ties should be adzed level with the base of the rail, so when rail is moved in or out from its original position it will not rest on a shoulder, for in that case rail would be inclined inward or outward, and when it found its level, which it naturally would in time, the gauge would change, and track would look as bad as it did before it was gauged.

It is as essential to have good gauge as it is to have

good line or surface, both from the standpoint of good appearance, and smooth riding. Tools required are: Adzes and handaxe; claw-bars, spike mauls and a long punch same size as a spike to drive stubs of broken spikes through the tie to permit using same hole for plug; and pinch bar to hold rail in place. This is better than drawing the rail with spike. Spikes known at "cuthroats" should not be used as they will allow the rail to go back when spike is driven down. The number of the different kinds of tools required can be determined only by the size of gang.

Yours truly,

Kansas. Roadmaster.

Gauging and Spiking

Editor, Railway Engineering:

The outside spikes should be opposite each other and the inside spikes likewise, to prevent the rails from creeping. Spikes should always be driven straight and close to the rail to avoid bending same and should never be driven closer than within 2 inches of the edge of the tie. Due care should be used in sending spike home, not to strike them too forceful on the last, as by so doing in many instances you bend the spike so that it is of very little service while the tie you are spiking remains sound, and when it becomes necessary to renew said tie, the spike in question is scraped, while it should have lasted as long as at least two cross ties, especially in the lower coast country. However spikes removed from old ties should always be burned before being redriven. By this means you are often enabled to drive many spikes and get good service from them, that would be wasted the other way as they are easily straightened.

GAUGING NEW TRACK.

Our more practical trackmen have learned long ago that a perfect gauge adds more to the general appearance of track than any item that might be given consideration. This can best be accomplished by first bringing your joints, centers and quarters to a perfect gauge, then the gauge should be applied to each tie. With the heavy equipment that is being handled today we must use the gauge on every tie.

We have laid 21 miles of 90-lb. rail this winter and I note that many of these rails were more or less out of true, or alignment, and should you attempt to gauge every other tie the result would be you would have track that could never be kept in perfect alignment.

RE-GAUGING AND SPIKING.

In order to regauge track, spikes should be pulled very carefully and ties properly adzed so as to give your rail a good level bearing, plugging the old spike hole with a tie plug. This should be made of Cypress, Cedar or Elm and be large enough to fill the old hole snugly so that your spike will not shift when redriven.

We are taking care of a very good traffic and we have had no accidents due to track spreading on our main tracks. Occasionally there is a minor derailment on some inside track where the rails are very light. My district embraces more than 180 miles of main tracks and more than 200 switches.

Yours truly,

Louisiana. Roadmaster.

Tie Plates

Editor, Railway Engineering:

We use on our roads the Wolhaupter shoulder tie plate with creases or forked in bottom, but I am recommending the same tie plate with flat bottom. I find that the creased or forked bottom allows water to gather under plate which either decays or rots the ties. Flat bottom answers the same purpose and increases the life of the ties at least 60 per cent. We have been using the first class white oak ties for main lines and branches where traffic is heavy. On lines where traffic is not so heavy we use cedar ties. In yards where our traffic is heavy, where there is lots of switching going on we use the second class white oak ties. I have not used any tie plate that I think will beat the Wolhaupter flat bottom tie plate for strength and for preserving the ties.

Now as for gauge on tangents and curves we use the standard 4 ft. 8½ in. gauge on all tangents and curves of 6 degrees and under. On curves from 6 to 10 degrees ½ in. wide and from 10 to 16 degrees 1 in. wide. We have none of these curves on our main line but on "Y's" and connections with other lines.

Yours truly,

Illiois. Roadmaster.

Track Drainage and Its Effect

Editor, Railway Engineering:

To begin with the life of track is based on good drainage. One of the most important items of track work is that of keeping the ditches clear and properly graded for drainage. Well drained earth will make a better roadbed than badly drained gravel or rock ballast.

In the spring as soon as frost is out of the ground section forces should be taught the importance of cleaning out their ditches for spring rains. In the autumn section forces should overhaul them, clean out leaves and other rubbish and put them in shape for the winter. In doing this work attention should be paid, getting even grades. Bolders or rock edges which interfere with a straight water way should be removed so as to avoid floating objects which cause ditch to fill up; attention should be paid to getting a good discharge at end of ditch in direction the current runs. The mouth of the cut should be at least three feet wider at the end than in the middle of the cut so as to give the water a free and easy passage and keep it away from the ballast line.

Surface ditches on top of cuts are a great necessity to keep cuts from washing and caving in. The ditch should be placed about 15 feet from edge of cut and same given as much attention as a ditch in the cut.

The ditch should be gauged in depth as to the amount of water that should fall at any time.

A ditch in a shallow cut, I see no objection to casting dirt on top of the bank especially on low side of cut where it will not be washed into the cut. In many cases where cuts are now over four feet deep I have used a greater part of the dirt that is taken from the cut on the high side, filling in ditches and small gullies caused by rain fall using balance of dirt for strengthening or building levee on inside of surface ditch. Where cuts are shallow as mentioned, the fills are generally light on either side and in many cases do not need bank widening, but in case of a weak arrow fill dirt should always be used on fills if it does not have to be trucked too far on push car.

The average cost of moving dirt from a cut with section forces will be about 35 cents per yard where the haul is not greater than 1000 feet. I do not think dirt should be trucked farther than that distance on our main line.

When I am out with a section gang I always impress on them the great importance of keeping track well drained, fills as well as cuts.

I have had dirt track which has been grassed from time to time throwing the grass about two feet from end of ties and when it rains the water would stand in the ditch at end of ties causing track to be center bound and churn in many places. I kept after this last fall ad got all of these ridges cut away; cut the dirt about one inch below end of ties giving a gradual slope to the edge of the dump and I find that it has been a great benefit to roadbed in hardening places that were always soft during wet weather.

I think all the grass and weeds should be cut off of track at least two feet from end of ties in the autumn after second frost. This is a great benefit to roadbed or drainage, prolonging the life of the tie, and is a great benefit to keep ties from burning out as I have had as many as five ties burned out of one rail length on account of heavy grass.

SUB-DRAINAGE AND TILE IN DITCHES.

Good track could be maintained in wet cuts without sub-drainage, especially in side hill cuts or gumbo cuts where water seaps through badly. Nothing else substantial will give relief.

The best and cheapest material for sub-drainage is common red clay drainage tile without collars, though a large tile with open joints is used in some cases. The smooth surface of this tile gives a rapid flow of water and consequently a reduction of saturation of the roadbed. Tile should not be less than four inches in diameter and great care should be taken to lay it properly, getting tight joints and uniform grade. The fall of grade should not be less than three inches to one hundred feet. When putting in tile on one side of the track it should be laid on upper side of cut. The cost of laying tile averages about 60 cents per rod, when section forces are experienced. The standard depth for putting in drain tile should be guided with requirements of where it is being used; generally a ditch being dug 3½ feet deep, filling ditch with about three inches of cinders lay tile to uniform grade and cover with 3 to 5 inches of cinders.

Oklahoma. Roadmaster.

Ties and Tie Plates

1.—Specification and inspection of cross ties.

Specifications—Not less than 8 feet 6 inches long, 7 inches thick, with no less than 8 inch face. Hewn on two sides from good live timber and barked.

Inspection should be made at point of shipment if possible, or at a tie yard at some convenient distributing point on the road, and should be inspected by regular timber or tie inspectors.

2.—Kinds of wood to use on different lines of system under various conditions.

On Main Line, white oak and yellow pine.

On Side Lines, white and yellow cedar and chestnut, except on curves above 6 degrees, which should be of hard wood (white oak or yellow pine).

3.—Statistics as to cost and life of ties now in use.

White Oak, cost about 55 to 60 cents, life about 7 to 9 years.

Yellow Pine, cost 49 to 58 cents, life about 6 to 10 years.

White and Yellow Cedar, cost 45 to 50 cents, life about 10 years.

Chestnut, cost about 48 to 52 cents, life about 10 years. Above in gravel or sand ballast.

4.—System regulating renewals per annum, per mile and per rail.

Inspection should first be made by inspection foreman for purpose of ordering the necessary number for renewals. At the time of such inspection the foreman to slightly chip the corner of tie (on line side) with an adze or axe, of all ties intended to come out. The supervisor can then inspect all or such portion of the ties to be renewed as may be necessary on each section.

Renewals should be made only where a tie will not give efficient service, do not think any number should be specified, per rail, or per mile. Renewals should be made in new ballast when track is raised. In ordinary renewals old ties should be dug out and new ones placed.

5.—To prevent destruction, in spiking, spacing, etc.

Spikes should be driven straight and far enough from edge to prevent splitting or bulging. All spike holes should be plugged as soon as spike is pulled. In spacing, ties should be moved with bar or other device, if necessary rail to be slightly raised to allow movement.

6.—Conditions for economical use of tie plates, and designs recommended.

Should be used in all cases of soft wood ties in main track and in turn out or other sharp curves on sidings and in all cases where the natural life of the tie is shortened by wear.

Design, Wohlhaupter and Glendon.

7.—Cost of putting in ties in different kinds of ballast, sand, cinder and gravel ballast from 9 to 14 cents.

Yours truly,

New York. Roadmaster.

[This letter was written some years ago upon request of engineer regarding conditions at that time.—Editor.]

Ties and Tie Plates

1.—Suggestions as to specifications and inspections of cross ties.

Cross ties should be made of live timber when the sap is in the wood. They should be hewn or saw hewn preferred. As to lengths 8 ft. is sufficient. The size as to width and thickness should be 7x9. The length should be allowed to vary one inch either way. The width of 9 inches should be rigidly enforced so as to have nothing under that width, but an inch wider could be allowed. The thickness, 7 inches, should be insisted upon. No perceptible variations in the thickness should be allowed.

2.—Kinds of wood to use on different lines of this system under various conditions.

Kinds of wood should be: White oak, yellow pine, cedar and chestnut. On the main tracks, viz., tracks 2, 2, 3 and 4, white oak and yellow pine should be used but not mixed. My opinion is that tracks 1 and 2 should contain nothing but white oak, and tracks 3 and 4 nothing but yellow pine. The material in these ties should be of prime quality No. 2 oak and pine ties, to be used in important yard tracks. I would also suggest the use of white oak switch timber in yard and main line turn outs. This timber to be 7x10 instead of 7x9, and come in sets cut to lengths. On lines with other conditions, cedar or chestnut ties could be used on straight tracks only. On curves of all lines I would recommend the use of yellow pine or white oak ties.

3.—Statistics as to the cost and life of ties we are now using, considered with reference to different kinds of wood under different conditions of ballast, traffic, etc.

The cost of ties we are now using, including freight charges, is as follows: white oak, 63 cents; cedar, 53 cents. The extreme life of oak and pine ties is not more than 9 years on an average; that of cedar 15 years. The safe life of the pine and oak will not exceed seven years, and that of cedar ten years. Pine and oak are destroyed by rot and cutting, and that of cedar by cutting and damage by respiking. The life of ties, however, depends largely upon the class of traffic they have to carry, as well as the conditions of the road-bed. With a good road-bed the life of a tie is increased at least one-third, as compared with road-bed badly neglected. The above is based upon the average conditions. Ties in stone ballast will last ½ longer than in gravel ballast. Ties in cinder ballast will rot much sooner than in any other ballast, approximately 1/3 quicker.

4.—System of regulating renewals of ties per annum, per mile, per rail, etc., main line and sidetrack, including best method of making renewals.

The regulating of the renewal of cross ties per year, per mile, is in my opinion a matter of safe operation. It is true the track is safe with some defective ties, but in case of trouble this fact is very difficult to substantiate. It is found that to good, even road-bed can be attributed the saving of rail and rolling stock. I am therefore of the opinion that ties in track should all be as near as possible of the same life. The manner of renewal should be determined by careful examination as to what is necessary to keep the ties in track in that condition from year to year, regardless of any fixed rule, keeping in mind the saving of material as much as possible. To determine this is simply to exercise good judgment and only take out such ties as are found decayed to an extent to make them of no further use in track. This system will usually require renewals of about one-seventh of the ties on main tracks, or 400 per mile, and about one-tenth in siding and yards, or 280 per mile. This would make the average for thirty feet of main track about 2 1/3 ties. It is, therefore, a safe and good rule to adopt, say, 3 ties per 30 ft. of track, after track is once in a uniform condition regarding ties. This same system may be carried out in regard to sidings by reducing the renewal on the one-tenth basis, or approximately to two ties per 30 ft. of track, equal to about 280 ties per mile of track.

5.—Directions to be observed to prevent the destruction of ties in spiking, spacing, etc.

A method to prevent the destruction of ties and timbers in spiking and spacing is to use extreme care and not re-spike until the old hole has been plugged, and then spike in the plug. Good results will be obtained in this respect if the plugging is properly done. Handling of ties in spacing should be done by moving them with a bar or driving them to position by the use of a broad-faced tool, so as not to bruise the wood. A large wooden mallet or broad-faced metal hammer should be used. The tie should be loosened enough so as not to require much pounding to get desired results.

6.—Under what conditions is it wise and economical to use tie plates? What design of tie plate is recommended?

My experience thus far with tie plates indicates that they should be used on every tie continuously or not at all, as tie plates used at joints only or scattered on intermediate ties, is the cause of adjacent ties on which there is no plate at all to cut, and does more damage than if there were no plates at all. They also are cause of kinky track, it being impossible to accurately gauge and hold gauge where plates are put on in a scattered manner. I am of the opinion that it is wise and economical to use them on curves of 2 de-

grees, 30 minutes and over, and also on all switch leads and curves from frogs in yards, in tracks constantly used. I do not recommend the use of tie plates on oak or pine ties on tangents, but think they should be used on cedar ties or any soft wood tie in all cases of main track or yard track if tracks are in general use. At this time I would recommend the use of the Q. & W. plate. It may be the opinion that the use of a tie plate will lengthen the life of the tie. This is true in regard to cedar or soft wood ties, but with oak, pine and other hard wood ties my observation is that the tie becomes rotted under the plate on account of moisture which the plate retains, causing a soft, decayed place the size of the plate. This reduces the life of the tie, in my opinion, equally, were there no plates used.

7.—Cost of putting in ties with different kinds of ballast; methods of working, etc.

Putting in ties with different kinds of ballast depends largely upon the quantity and kind of ballast at hand. Under usual conditions the cost of ties put in dirt, cinder, gravel and stone ballast is as follows: At the rate of wages paid on the system, dirt ballast, 8 cents per tie, cinder ballast 7½ cents per tie, gravel ballast 10 cents per tie and stone ballast 16 cents per tie. This, however, depends largely upon the traffic and other conditions where the work is being performed and the above is figured from average conditions. The method of doing the work, putting in ties, varies very much in accordance with conditions at hand. If it is possible to give the track a slight raise, which should only be done in the early part of the season, ties in all kinds of ballast may be renewed in about the same manner which is by giving the track a partial raise just enough to allow the slipping out of the old tie and putting in of the new tie. This will allow a slight finishing raise which when the track is gone over the second and third time will leave it in good and uniform surface. This manner of renewing ties disposes of considerable material that would otherwise have to be handled twice. If ties are put in where the old elevation of rail is to be maintained care must be taken and not disturb the old bed. This can be done by selecting ties of a like thickness of the ones which are taken out providing the renewals are scattered and only require a slight raise of the rail to permit the taking out of the old tie and replacing it with a new one. In this manner ties are kept close to the old bed and require very little surfacing to finish up. A very good method to renew ties is to hold the track as near as possible to the old bed then dig out between the rotted ties a very little deeper than the old bed. By pulling the spikes from the old ties you are able to spring the rail on either side of the hole which has been made and then by slipping a spike under the rail the old tie can be placed in the depression, pulled out and the new tie put in in the same manner from the opposite side of the track. This manner also requires very little tamping to hold to a good and its present surface. This method is very safe and quick in all kinds of ballast except gravel or stone in which case the usual amount of tamping is necessary. There are certain rules required on all railroads for putting in ties, such as lining the ends, spacing, etc., which should be strictly adhered to. Regularity in spacing of ties is a very important matter in the way of renewals. Section gangs while making a specialty of putting in ties should divide their gangs into smaller gangs of three men each.

Yours truly,

New York. Roadmaster.

[This letter was written some years ago upon request of the engineer.—Editor]

Ties and Tie Plates

As to inspection I would suggest that a good competent man be put in this position and no ties accepted that were not up to standard and that all such received should be counted out and marked as culls.

Ties for main track use should not vary over 2 ins. in width or over 1 in. in thickness and should be all of uniform length.

2. I would suggest that cedar ties for all branch lines with tie plates and white oak or hard pine for main line, oak preferred.

3. Good quality cedar ties with tie plates with traffic as on our branch lines should last from 12 to 14 years providing tie plates are used to prevent cutting, and gravel and cinder ballast is used. On sand ballast from 8 to 10 years. Hard pine good quality gravel ballast or cinders from 7 to 8 years and on sand 5 to 6 years. White oak good quality gravel ballast or cinders 8 to 10 years. On sand from 6 to 8 years.

4. As to system regulating renewal of ties per rail and per mile would say that I think this is a difficult matter to get at as some years 25 to 50 more ties will be needed on some miles than on previous years. As to making renewals I would say work should be done early in the spring as possible, while ground is soft and weather cool. To renew old ties spike should be started each way from ties to be removed so as to allow the rail to be raised sufficiently to allow old tie to be pulled out. Soon as old ties are removed place for new tie should be cleaned so that new tie, when in, would be perfectly tight and if necessary rail should be sprung so as to get tight fit but rail should never be sprung so as to take bearing off of old ties after new ties have settled. This does not refer to rock ballast.

5. As to method of spiking and spacing to prevent destruction of ties. All ties put in should be so done as to be in their proper place both as to line and spacing before same is spiked, then line side of track should be spiked first and gauge side next, always to be sure when spiking to use gauges. As to spacing ties when this is to be done after laying new rail and when necessary to move old ties to get same in proper place track should be given a light lift, ties spaced and all

newly tamped in spacing. Ties should never be pounded with small faced hammer, best method is to have two men with bars move ties to place after track has been lifted and if necessary to use hammers, a sledge should be used with a good large face.

6. As to use of tie plates I would say same should be used on all cedar ties in main track and passing track and also on sidings in yard where traffic is heavy to save cutting of ties. For cedar ties I would recommend a tie plate such as Glendon or Wohlhaupter as we now use.

7. As to cost of putting in ties. To put ties in on gravel ballast 12 per day per man and on sand 15 per man per day. Cinder ballast is about same average as gravel. Method of working is as I have stated before, raise, pull out old ties and fit in new ones, so very little tamping, if any, will be necessary.

Yours truly,

New York. Roadmaster.

[This letter was written some years ago upon request of engineer.—Editor]

Ties and Tie Plates

All ties should be not less than 7 ft. 11 ins. and longer than 8 ft. 1 in. should be sawed off. All main track ties should not be less than 6 ins. thick by 9 ins. wide hewn smooth on all sides, free from sap and black knots.

2. I think that yellow pine ties the best for main track in any ballast as the frost leaves them quicker in the spring than cedar and other soft wood ties.

3. Yellow pine ties are costing fifty-four cents. The life of this tie in clay ballast is about seven to nine years; in cinder ballast about six years and now I am having my first experience with stone ballast therefore cannot give any report.

4. I find the best method of making tie renewals is to raise the track about two inches tamping the ends of ties to remain in track, removing all ties that will not last another year. Ties are more quickly spaced and with less damage to the ties. In side track renewals where possible raise the rail enough to remove the old ties, level the bed, put in the new tie and when spiked there will be very little surfacing to be done.

5. All ties should be placed at right angles with the track and should be firmly held up to the rail. Spikes should be driven straight. The habit of starting spike at an angle and drawing them up straight as they are driven should not be allowed as it leaves a hole at the side of the spike and is apt to split the tie. A good way to space ties is to have a tie with four pins as handles with this as a ram ties can be moved without damaging them.

6. I think tie plates should be used on all ties on curves and on all joint ties as they hold the track to gauge and protect the ties. I would recommend the Goldie tie plate as the tip forms a brace and lessens the wear on the spike.

7. Ties can be put in gravel ballast for about twelve cents and in stone ballast for seventeen cents. Track should be slightly raised first, this will loosen the tie, making it less trouble to remove the old tie and put in the new tie. Hoping this will meet with your approval, I remain,

Yours truly,

New York. Roadmaster.

[This letter was written some years ago upon request of engineer.—Editor]

Wages and Employees

Figures just compiled covering the operations of the various portions of the Pennsylvania Railroad System, East and West of Pittsburgh, show that in 1908 these lines paid out in wages the sum of $125,543,947. This represented a reduction of $29,471,951 in wages as compared with the $155,015,898 expended in 1907. In the latter year the companies employed an average of 199,000 men, while in 1908 the number was 175,000—a reduction of 24,000 men.

Though there was such a large decrease in the total sum paid for wages, the rate of wages as established in 1907, which represented an increase of 10 per cent over the rate paid during the greater part of 1906, was maintained for all classes of employees without abatement through 1908. This increase in the rate paid, together with minor readjustments of wages, amounted to some $15,000,000 annually.

In 1907 the gross earnings from operation of the companies included in this compilation were $321,478,308, and in 1908 they were $267,559,213—a loss of $53,919,095. It will appear therefore that in 1907 the company paid for labor a sum equivalent to 48 per cent of its total earnings from operation, and in 1908 wages absorbed a sum equal to 46 per cent of the total. Of course, not all payments to labor were chargeable against the gross earnings, but it was nevertheless these earnings which directly or indirectly made possible such large payments to labor, and which rendered necessary the radical reductions in such payments when business fell off.

The fact that the necessity on the part of a railroad company to keep most of its plant going even in times of severe business depression, makes impossible an adjustment of its expenditures to its earnings such as a manufacturer may bring about, is made clear by comparing these figures of the Pennsylvania System with those of one of the largest manufacturing companies in the country. The industrial corporation's annual report shows payments of $160,825,822 for the wages of an average of 210,180 men, against the railroad's payment of $155,015,989 to an average of 199,000 men in the prosperous year 1907, yet when the slump came in 1908 the manufacturer was able to reduce his force to 165,000 men and his payments to $120,510,829—a decrease of 45,000 men and over $40,000,000 in wages, while the railroad company could curtail its force by but 24,000 men and thereby reduce its wage payments by $30,000,000.

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Railroad Accidents

During the months of January, February and March, 1909, it is reported in Accident Bulletin No. 31 that 177 persons were killed and 2,618 injured in train accidents, and in accidents of all kinds there were 663 killed and 15,122 injured. This is a very favorable showing when compared with previous reports and it must also be remembered that traffic has increased considerably since last year. In the last bulletin 798 persons were reported killed and in the bulletin of a year ago 728 persons were reported killed.

In the quarter ending March 31, 1909, there were 2,284 collisions and derailments, of which 1,042 were collisions and 1,242 derailments. The number of collisions and derailments that affected passenger trains were 168 and 145 respectively. By these accidents the resulting damage to cars, locomotives and roadway amounted to about $1,850,000. Out of 29 prominent train accidents, there were 13 butting collisions, 14 derailments, one rear collision of passenger trains and one collision classed as miscellaneous.

Regarding accidents to employees in coupling and uncoupling cars the accidents resulted from the usual reasons. The causes for the greater number of casualties were adjusting coupler with foot, fingers caught between uncoupling lever and body of car, opening and closing knuckle in connection with miscalculated speed of cars, and unexpected movements of cars. There were in all 44 employees killed and 535 injured in the quarter ending March 31, 1909. The same number were killed in the previous quarter.

Education for Railroad Service

A few notes are here made of an address by Mr. L. H. Turner, superintendent of motive power, P. & L. E. R. R., before the Railway Club of Pittsburgh on the subject of "Practical Education for Railroad Service." In the first place he suggested that the qualities, induced by proper practical education, were necessary for all men and not only for railroad men. The lines of practical education, as he suggested, are in accordance with the present development of our country, industrially and otherwise. He takes up especially the moral and general intellectual development of the producing classes, believing that the training should be such as to make them eligible for positions of trust and to make them capable of receiving a clear understanding of the relation between capital and labor. Two paragraphs, containing sound arguments, are quoted as follows:

"The time must come when the employee, instead of resorting to force to gain his ends, will meet his employer upon a common footing, the one with his labor to sell, and the other with the money to buy. Labor occupies the same position in the market as any other commodity, the law of supply and demand invariably governs the amount purchased, and those offering the best grade of goods make the quickest sales and at the best prices. The employee must learn that business is obtained on a competitive basis, and that by an intelligent and economical use of his time and the material placed in his hands, he can to a great degree assist his employer in obtaining the business and then turn it out at a profit, and he must not expect to have steady work at good wages unless the employer has a steady business, transacted at a profit. The employee must learn that, in order to make his services valuable and to be desired, he must take a live interest in the affairs of the company that employs him, and realize that any waste of time and material spoiled is a dead loss to the company and must be paid for by some one. The company must have a fair return upon the money invested or go out of business, and the loss is usually made up by the payment of low wages or reduction in wages.

"If the amount of money irretrievably lost each year through the carelessness and indifference of workmen could be saved and paid to the workmen, the cry of low wages, suffering and hard times would never be heard. Inasmuch as 95 per cent of the producing classes have little or no education and could make but little use of it if they had it, I claim that a practical education consists of one that makes the man fair in his dealings with his fellow-man, makes him

realize that in order to make himself valuable and his services in demand, that he must be temperate, industrious, prompt at his work, and in following all directions, and in doing this he is not only profiting himself, but by his example is giving to others the most useful and substantial practical education that any man can receive."

Fire Extinguishers for Railroad Use

Inasmuch as the fire extinguisher is of interest to our readers, the construction and advantages of the "Premier" fire extinguisher, manufactured by the Durafort Company, 2 Rector street, New York, are explained.

The most important feature of the "Premier" is that it requires no protection against freezing because a non-freezing liquid solution is used that will not freeze at a temperature 60 deg. below Fahr. This extinguisher will not discharge itself if it is turned over, thrown down or subjected to rough usage and this feature is of special value in railroad use. Another important feature is that it can be charged and discharged very quickly and it is claimed that a fire can be put out by the time any soda and acid extinguisher can be charged.

It is claimed that the "Premier" will throw a solid stream of water 60 feet in length from the moment the lever is raised until the last drop of water is exhausted and that it does not, as other extinguishers, gradually reach a maximum stream of water. It does not require cleaning before it is recharged and requires no further attention after it is once loaded with a gas cartridge. The "Premier" does not contain injurious acids and can be left hanging for years before it is used.

CONSTRUCTION.

The motive power of the "Premier" is supplied by liquified carbonic acid gas contained within a small steel cartridge, or bottle, held and operated by means of a special device within a tank containing 2½ gallons of a liquid chemical. The tank is made of 16-gauge cold drawn steel, tested to 700 lbs. hydrostatic pressure, and thoroughly protected against corrosion. The cartridge or gas capsule is of 14-gauge seamless cold drawn steel, tested to 4,000 lbs. and upwards hydrostatic pressure, and is fitted with a valve, which closes by interior pressure when the cartridge is charged with carbonic acid gas CO_2. The cartridge when filled weighs about three ounces more than when empty. The weight empty is stamped on each cartridge. Each cartridge is fitted with a small metal seal, which, as long as it remains unpunctured, shows the cartridge is fully charged. Cartridges can be recharged as often as required and at a very small cost.

The cartridge holder is of cold drawn steel and is screwed into the head or cap, and securely holds the gas cartridge by means of a bayonet joint.

The cap is of hard brass having a threaded boss to fit the cartridge holder, and is fitted with the pressure controlling mechanism, which consists of a rack and pinion with an outside lever connected to the pinion so that raising the lever will force a plunger against the valve of the cartridge held directly beneath its center. This releases the gas held under pressure in the cartridge and instantly causes the liquid to be expelled from the extinguisher. The rod or plunger is enclosed by the form of the cap casting, and gas or liquid is prevented from passing it by a packing gland.

The tank is filled with a specially prepared solution which will not freeze and which possesses a very high fire extinguishing efficiency.

The Romance of Carborundum

The opening chapter of the story of carborundum really should begin, "Once upon a time there was a man who worked in a little shop," for the story of this wonderful abrasive is surprisingly like the good, old fairy tales which emanated from the mind of one Grimm.

Of course, none of the grown-up people believe in fairy tales nowadays, but not only the "grown-ups" but the "grown-ups" with the master minds are forced, even in this day and age, to believe in the miracle of carborundum.

For instance, there was Prof. James Geikie, the noted Scotch scientist. When he was first shown samples of carborundum crystals and told that they had actually been manufactured, he would not believe.

"Why, those crystals have been in the earth for a million years!" he exclaimed.

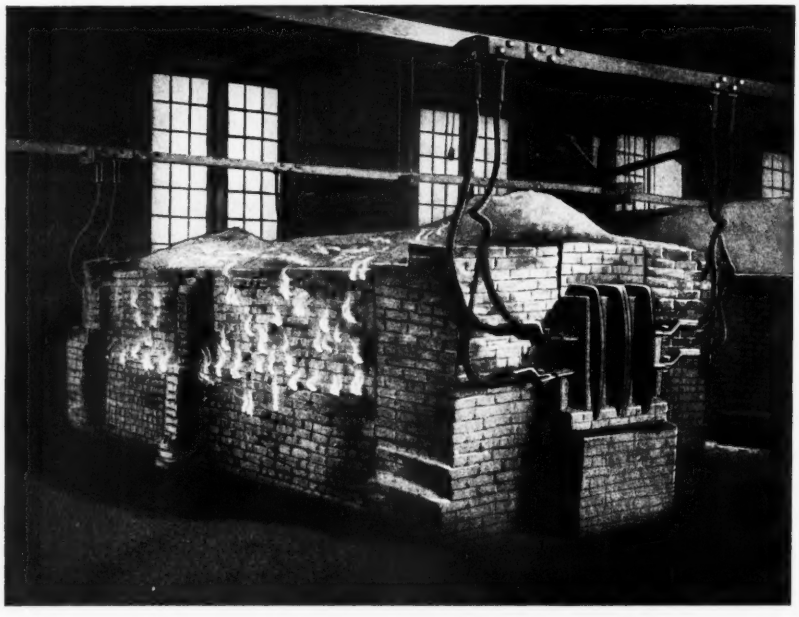
But Prof. Geikie was later convinced that they were manufactured products and he believed in the miracle of carborundum.

Then there was Mr. Kunz, the noted gem expert from the famous house of Tiffany. He was at a loss to place carborundum crystals when he first saw them. He, too, was loathe to believe that they had been manufactured, but later his master mind, like that of Prof. Geikie, was changed, and he believed in the "fairy tale of carborundum."

Carborundum is about sixteen years old, it being in 1893 that "the man who worked in a little shop" discovered the product. The man was Edward Goodrich Acheson, and the shop was located at Monongahela City, Pa.

Mr. Acheson was experimenting with an electric current, some clay and some coke, when he made his wonderful discovery. The clay and coke he put in a small iron pot or bowl, such as plumbers use. Into this mixture he stuck a carbon rod, from which a connection was made to one pole of a dynamo. The current was turned on and the clay and coke became a molten mass. When the carbon rod was withdrawn from the bowl, the trained eye of Mr. Acheson discovered some minute crystals adhering to it. These crystals were found to be so hard, so sharp and so beautifully tinted that for a time the discoverer thought that at last a man-made diamond was possible.

The new crystals, however, lacked the transparency of the diamond, but so far as hardness and sharpness



Carborundum Furnace Burning.

were concerned, were equal to the nature product. Just what they were the inventor, or rather discoverer, really did not know. He collected enough of the new crystals, from other experiments, to fill a small vial, and these he took to the gem experts in New York.

The experts were, after some persuasion, induced to test the abrasive powers of the new crystals on some precious stones. The results were startlingly successful, and Mr. Acheson got his first order for the new product, which he called "carborundum," at 40 cents a carat. He then went back to "the little shop," to make carborundum by the pound instead of the carat or ounce.

Today the down-to-date farmer sharpens his scythe with these near-diamonds, but of course not at the first jewelers' prices. The improvements in the process of manufacture, the subsequent creation of a demand for the product, which so rapidly took the place of the natural abrasives, all tended to lower the cost of production and thus bring down the market price.

Today at The Carborundum Company, at Niagara Falls, there are twenty-four mammoth furnaces which yield 7,500,000 pounds of carborundum a year, instead of one little bowl-and-rod furnace which sixteen years ago gave an ounce or so of this remarkable abrasive to the world. This tremendous growth has been possible—first, because of the superiority of the product; and, secondly, through the untiring efforts of the heads of the company toward improving their product and then letting the commercial world know of these improvements.

The process of manufacturing carborundum today is practically the same as it was fifteen years ago, only that everything is done with greatly improved methods and on a greatly enlarged scale. Sand is now used instead of clay, because it was soon learned that the element silicon was one of its chief requirements, and the crushed coke supplies the element carbon.

This mixture is placed in the big rectangular brick-and-iron furnaces in great gravelike mounds. At each end of the furnaces four heavy cables are attached, these cables connecting directly with a core of crushed coke running through the bottom of the furnace bed. These cables carry 1200 horse-power of electricity generated by the waters of Niagara Falls. For thirty-six hours this tremendous power is shot into the furnace, and it generates heat which has never been accurately registered, as there is yet to be invented an instrument which will withstand this heat long enough to make an actual record.

In this awful heat granite would be turned to molten liquid, and steel and iron sent away in vapors. If a person were to look for an instant into the heart of a burning furnace, blindness no doubt would result. The degree of heat is estimated at 7500 degrees Fahrenheit, and when one thinks of the discomforts of 90 degrees in the shade, some remote idea of the heat generated in a carborundum furnace might be gained. Incidentally, enough electric power is used in one furnace run of thirty-six hours to carry a turbine steamer half way across the Atlantic.

This is the inferno in which carborundum crystals are created. They fly together in masses indescribably beautiful.

At the end of thirty-six hours, the sides of the furnace are taken down and the thick, black, ugly coating is removed. Like the most humble of Portia's caskets, this ugly covering hides the jewels, for the crystal masses reflect, accent and glorify the radiance of gems. New purples, new greens, new azures and golden tints are discovered in almost every crystal mass—colors which the cleverest artist would despair of truthfully reproducing.

The crystal masses are taken from the furnaces, broken and crushed, to the individual crystals, beneath immense steel wheels; the grits and powders, thus

secured, are washed and then graded and graduated by screening through silk screens of different meshes.

The different grits and powders are then mixed with bonding materials, which in themselves are good abrasives. The grains and the bond are so thoroughly mixed that each separate grit or crystal is entirely surrounded with the plastic material, and after this operation the mixture is placed under immense hydraulic presses and fashioned into the different sizes of grinding wheels.

The wheels, after being thus shaped, are placed in immense kilns similar to those used by potters, and are there vitrified at heat estimated at 2500 degrees.

It is doubtful if there is any branch of industry where a grinding wheel gets a more complete or a more rigorous test of its genuine worth than in a railroad shop. All kinds of grinding, from the finest and most exacting tool work to the roughest casting snagging, is done in these immense repair terminals, and when a wheel supplies all of these grinding needs it comes pretty nearly being made of the ideal abrasive material. In every department of nearly all the big railroad shops of the country carborundum wheels will be found.

There are certain characteristics of carborundum and carborundum wheels which put them in a class all by themselves. Carborundum is the hardest and sharpest abrasive material the world has ever known; carborundum wheels are made of this wonderful abrasive combined with an unequal bonding material and are the results of the experience and brains of grinding experts.

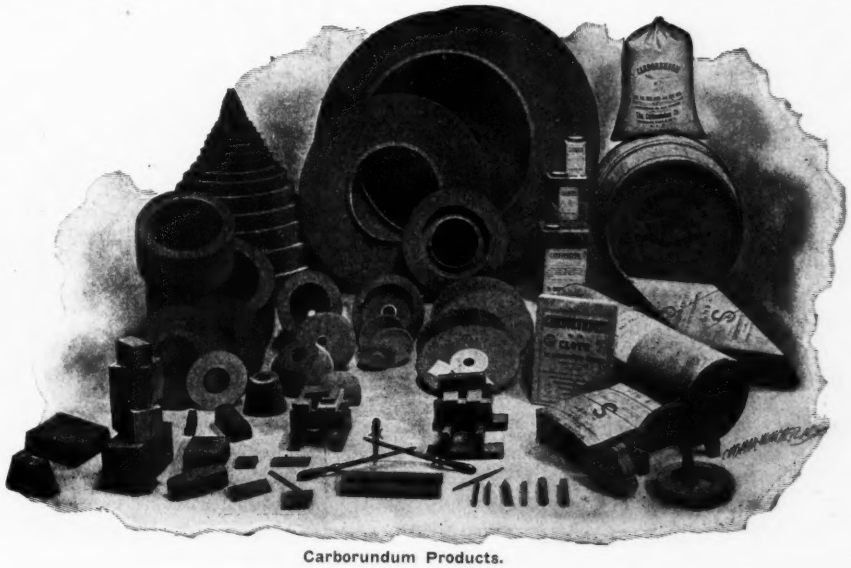
In using the word "grinding" in reference to carborundum wheels, it is used in its common rather than in its strict sense, for carborundum wheels do not grind—they cut, and cut clean and free and absolutely without frictional heat. The action of the carborundum wheels is more like that of the lathe tool or the planer, rather than the rubbing brick. This is due to the fact that carborundum is so intensely hard and so exceedingly sharp and at the same time slightly brittle. In its original form carborundum is crystalline, and it never loses this form. It is these tiny crystals which do the cutting. When a piece of metal is forced against the surface of the wheel, these crystals being slightly brittle, split and break, under the pressure, into smaller crystals. Each new crystal presents a new, fresh sharp cutting edge and the wheel is thus enabled to remain free-cutting, unglazed and to do from three to five times as much work in a given time as other wheels.

Carborundum wheels are made in all grits from No. 6 to 220 and some in F, FF and FFF powders and in twenty-five degrees of hardness. In all over 100,000 wheels are carried in stock at the big carborundum plant, and from this large and varied stock the railroad mechanic is assured of getting just the right wheels for his work.

Every wheel before it leaves the carborundum factory is given a minute inspection and a most rigorous speed test. It is found that for all practical purposes wheels over 8 inches in diameter should be fit to run at a speed equivalent to 5,000 surface feet a minute. Carborundum wheels of this dimension and over are speeded to at least 70 per cent over the rate at which they would be run under normal grinding conditions. Every test is made under the most exacting conditions by responsible men who make a sworn statement attesting to the fact that every wheel is in perfect condition when it leaves the plant. This method assures the Carborundum company against the possibility of their wheels breaking while being operated under normal conditions.

For general tool grinding, twist drill, reamer, link and guide bar grinding, carborundum wheels have indeed gained a most enviable reputation; in snagging castings and in all rough grinding they have proven beyond a doubt that they can do more, better and faster work with less wheel loss than wheels of any other abrasive material.

For the finer work of tool grinding, carborundum



Carborundum Products.

wheels always produce a keen, fast cutting edge—an edge which lasts and adds a pleasure to the day's work. Carborundum wheels never heat or draw the temper from the finest tools.

Another carborundum product which has met with a decided success in railroad shop work is carborundum paper. Carborundum paper is rapidly replacing emery and sand paper in railroad shop work. The best quality of paper, the finest grade of glue and carefully graded carborundum grains are what make carborundum paper the success it is.

Car repairers and builders find carborundum paper unexcelled for removing paint and rust. The grains being so hard and sharp and carborundum paper being such a perfect product, the car repairer is enabled to do from two to four times as much work with carborundum paper than with any other abrasive paper known. An immense stock of carborundum paper in all grits from No. 24 to FF is carried at all times. Sample books and other information regarding this product can be had by addressing the company.

Carborundum valve-grinding compound, another of the carborundum products, will also be found invaluable to the railroad mechanic. The valve-grinding compound is made of very fine carborundum grains mixed with a high-grade grease. For all steam pipe and air brake valve work, or in fact in all such work where a true seat of contact is required, carborundum valve-grinding compound will be found to be without an equal. It is made in two grades—the coarse and the fine. The coarse is used first and the fine compound used to give the polished, finished surface to the valve seat.

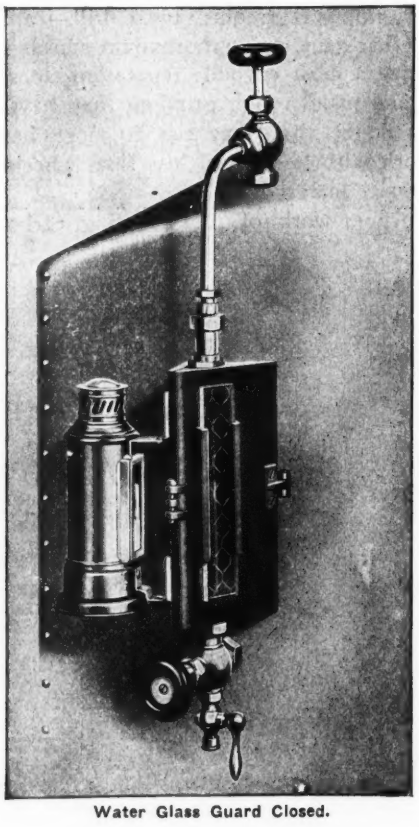
The Carborundum company is located at Niagara Falls, N. Y. It is the only company in America which manufactures the wonderful abrasive carborundum. Besides making the above-mentioned carborundum products, the company manufactures the famous carborundum sharpening stones for all mechanics' uses, Garnet Paper and Cloth for general wood-working and finishing and for the finest cabinet and joining work.

Water Glass Guards

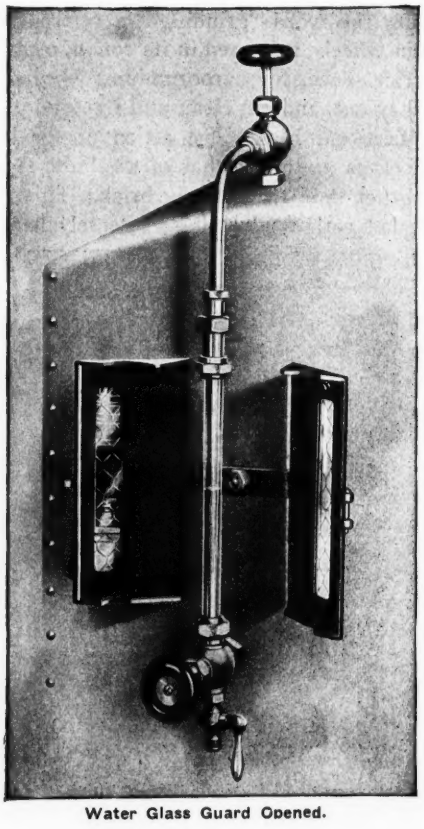
The water glass guard is an appliance that results in an unusual reduction of accidents and expense. In a few words the large number of accidents, which occur from bursting water glasses, are avoided together with damage claims, as well as train delays and other serious troubles.

Water glass guards are used for many obvious reasons. The only question open to discussion is the best guard on the market, so a brief description is here given of the "Positive" water glass guard made by the American Steam Gauge & Valve Mfg. Co., Boston, Mass.

The accompanying illustrations show the guard in closed and opened positions. It is seen that this guard consists of two frames or doors of malleable iron swinging on hinges which are attached to a bracket secured to the boilerhead by studs. The doors are designed to completely cover the water glass and to



Water Glass Guard Closed.



Water Glass Guard Opened.

stand at such an angle with the boilerhead that light is reflected through sight glasses.

The sight glasses are made of heavy plate glass with woven wire insert so that the danger of broken glass is eliminated. The latter feature is one of the important points in the design and outside of the durability and strength of the entire appliance, it should be noted particularly. These sight glasses are placed, moreover, in slots in each door directly in front of the water glass and give a perfect view of the water level at all times.

This "Positive" guard is a permanent fixture on the boilerhead and so it can not be thrown away or lost. It lasts as long as the boilerhead and costs nothing for renewals.

In the matter of train delays, mentioned above, which are caused by the inability of the enginemen to locate and shut off cocks, the cocks can be found immediately and closed with the bare hand when this guard is applied.

The "Positive" guard saves time when water glasses are renewed, because there are no parts to remove or lose. After the glass is applied, the cocks may be opened quickly with no danger whatever. No change in water glass fixtures is required and at small cost this guard may be attached to any boilerhead.

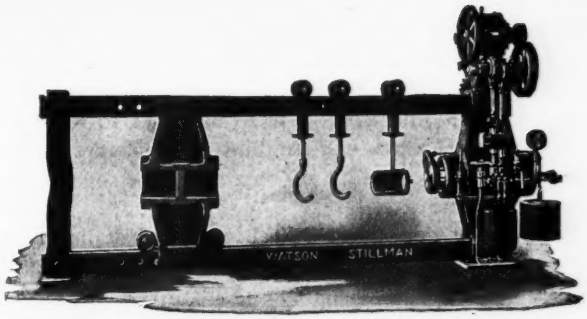
In ordering water glass guards, give the distance from boilerhead, or lagging, to center of water glass and if head is lagged, give thickness of lagging. The distance between packing nuts and the diameter of same are also required.

Hydro-Pneumatic Wheel Press

Two reasons are advanced for the superiority of the new hydro-pneumatic wheel press, built by the Watson-Stillman Co., of New York, and these are that the ram can be moved up in less time and that the construction is lighter in weight.

This hydro-pneumatic operating system gives quicker movement of pneumatic tools, and this, combined with the certainty and power of a hydraulic press, greatly increases the capacity of the machine, while at the same time air pressure from the shop system is made available to facilitate the work.

Referring to the illustration, air is connected through a separate three-way valve to the closed cylindrical reservoir at the right. When the ram is at the back end of its stroke, as shown, this reservoir is almost filled with water. The admission of air to the reservoir forces the water under pressure through the pumps and into the main cylinder, thus pushing the ram out at several times the speed that can be obtained where the water must be drawn into the pump by suction. In fact, the ram can be brought against the wheel or axle in a jiffy. There is the further advantage that when the ram stops under air pressure, both pump pistons are immediately acting to force the ram further. The result is a more steady movement than with the regular two or three speed hydraulic construction.



Hydro-Pneumatic Wheel Press.

While the above-mentioned feature of hydro-pneumatic operation has been the basis of the popularity of this machine, special attention is called to the four-rod construction. It is found that when the lines of pressure and resistance lie within single rods at top and bottom there is a tendency on heavy work for the press to spring sidewise, as it is practically impossible to keep the strains within such narrow limits. In the Watson-Stillman hydro-pneumatic press two heavy rods have been used at both top and bottom, the rods being from three to six inches apart. The ram and moving abutment are centered between these, so that there is no tendency to spring out of line. The work will be well squared up in this four-rod construction, and there is the added advantage that no heavy base plate is required.

This machine embodies careful design and workmanship. All parts under stress are of a good quality of steel, while the smaller and working parts may be depended upon to withstand hard usage without showing under wear. The cylinders are protected by copper lining.

The moving abutment is supported by four wheels, with base wide enough that it may be moved with ease and safety. The suspension hooks and compression cap are supported by two-wheeled trolleys. The machine is furnished with motor drive as shown, or if preferred, is provided with suitable pulleys for belt drive. In the latter the pulleys should run at about 125 revolutions per minute.

How Graphic Recording Instruments Save Waste

The exhibits of the Westinghouse motor and curve drawing meters connected to various machine tools at the Atlantic City conventions has attracted considerable attention because of the possibilities which it affords of detecting waste and delays in shop methods previously unknown to exist.

As an example of a saving which the use of these meters produced by indicating a source of delay, the following case may be noted:

A comparison of records obtained from lathes which were roughing out motor shafts showed that in one there were stops averaging five minutes each while the shaft was being taken out and a new one put in or a shaft half completed was being reversed in position; while in the other the delays averaged ten min-

utes, just twice as long. Naturally some explanation of this discrepancy was looked for. It was found that the shorter time for changes and reversals occurred on a shaft small enough to be handled entirely by hand, but the other shaft was so heavy as to require the services of a crane in handling. The delays were due to the impossibility of obtaining the overhead traveling crane at once.

To remedy this defect a jib hoist was installed beside the lathe and the material was handled in and out of the lathe by the hoist. The result was a saving of ten minutes on the time of each shaft, which amounted to 205, and meant the completion of two more shafts a day.

Similar delays exist in every shop and go on for years without being detected because they are small and escape notice. There are so many reasons why the machine tools must be shut down that it occasions no inquiry when a tool is seen not working, and hence it is only when a graphic log of all the operations is put before him that a foreman can detect the weak points in his shop system and then go ahead and correct them.

Lighting System

At the exhibit of the Safety Car Heating & Lighting Company Atlantic City, New Jersey, many important devices were shown in a way to engage interest. The company followed its usual policy in showing these devices in operation and this was again a strong feature of the exhibit.

A demonstration was made of the operation of the Vapor Lighting Equipment recommended for Branch Line service where Pintsch gas is not available. The carburetor, regulators and lamps were all to be seen in support of the representations that the system will give a magnificent light at an exceedingly low cost. In this line of apparatus, the company also exhibited for the first time its locomotive head light, wherein the means of illumination is an inverted mantle brought to incandescence by carburetted air. Actual service tests have shown the ability of this equipment to furnish a soft white light of such volume as to greatly improve the oil burner and still avoid an undesirable intensity. Efficiency and economy are two of the strong arguments advanced for its use.

In the heating devices, the company's exhibit was complete and covered all phases of the present-day demands. Those concerned in this field will be particularly interested in the Thermo-Jet System, an equipment insuring automatic regulation of the car temperature, available for use with or without pressure as desired. Service tests have amply proven the elasticity claimed for this system.

A direct steam regulating system for use with pressure is designed to give regulation over the number of radiator pipes heated; that is, from one to all four pipes in a passenger car may be used at the will of the trainman, thus insuring a comfortably heated car in either cold or mild weather.

The standard hot water circulating system with jackets located entirely inside of the car with the company's double shell heater, was shown in the exhibit.

Samples of the Safety Company's steam-tight couplers, automatic steam traps, train pipe valves and locomotive reducing valves were exhibited to show the substantial workmanship throughout in the manufacture of this company's specials.

Two New Hydraulic Jacks

Anyone who has much heavy lifting to do appreciates that there are pleasanter tasks than carrying around a jack from one place to another, especially when it weighs more than a hundred pounds. It means rather a heavy load if carried by hand, and if the jack is loaded and reloaded onto a truck with each using, this involves considerable work, too.

The new Watson-Stillman shop jack, which is shown in the first illustration, renders unnecessary much of this labor. This jack, made in eleven sizes, of from 20 to 50 tons capacity, and lifts of 12 and 18 inches, fills all the ordinary requirements of lifting heavy machinery and for general shop work. The wheels on the base and the handle on the cylinder facilitate moving the jack quickly from one place to another without the exertion of a great deal of energy. The wheels touch the floor only when the jack is tilted, so they

Shop Jack.

are never in the way during the lifting operation. If it is desired to use the jack at an angle, it can be tilted in the opposite direction to the wheels, and when it is laid flat upon the side, the ram will push out to its entire lifting length. The head is enlarged sufficiently that the jack will not stop working for lack of filling, even if there has been slight leakage. An independent steel claw (not shown in the illustration) can be used when desired for lifting from near the ground. This is more convenient than a permanently attached claw, as the independent part is easily applied when a low lift is required, and its removal at other times allows the jack to be made of considerably lighter weight. The weight, however, is comparatively small because the whole jack is made from steel, and the parts under greatest strain, such as the ram and

Independent Pump Hydraulic Jack.

cylinder, are machined from a solid bar of higher carbon steel than usually found in hydraulic or other jacks. This jack, though plain in construction, has proven very reliable in service, and on account of its special design greatly facilitates the handling of heavy equipment.

It is sometimes inconvenient to work the lever of a jack at the internal pump type because of the lack of room or insufficient footing. There are other places where only a short space is available to place the jack —another condition which cannot be met successfully with the ordinary inside pump jack. This is especially true in bridge, ship and dry dock work, etc. Even in more common work it is sometimes to the operator's advantage in the way of getting a better footing, more power or safety to be at a considerable distance away from the jack. To meet these conditions the Watson-Stillman Co. put upon the market the independent pump hydraulic jack shown in the second illustration and which they furnish in 53 sizes of from 2 to 1,200 tons capacity. The various sizes of the jack proper have maximum ram movements of from 4 to 8 inches. The pump is connected to the jack by means of flexible copper tubing, which may be of any length suitable to the work in question. The jack may be operated up to a pressure of 450 pounds per square inch on the ram by means of the extension lever. The gauge may read in pounds per square inch, or in tons load upon the jack, or both. This is not furnished when the jack is to be used for ordinary lifting, but is necessary in testing. When equipped with gauge, the jack may be used between two fixed platens for making compression tests, testing the tightness of forced fits, etc.

Both of the above jacks are made by the Watson-Stillman Co., of New York, and embody the usual Watson-Stillman characteristic of being able to stand a considerable overload without danger of injury to the operator or jack.

Interchange

The subject of a paper, prepared by Mr. Jno. J. Baulch, was Interchange, but the paper did not refer to the interchange of cars. In his interesting paper he took up the question of the development of our country by railroad construction and also that of railroad legislation.

The paper was prepared by Mr. Baulch, superintendent Manufacturers' Railway, for the Society of Railway Club Secretaries' annual convention and is printed in the Proceedings of the St. Louis Railway Club.

Cars for Pedro Miguel Plant

Delivery has been completed of the twenty cars to be used in hauling concrete from the mixers in the forebay of the Pedro Miguel Locks into the lock chambers. These cars are 12-ton flats, with double four-wheel trucks of 3-foot gauge, and are 18 feet long and 7 feet 2 inches wide. They are constructed all of metal excepting the floor, which is of creosoted white oak, three inches thick. The platform is 2 feet 4 inches above the rails. They are fitted with air and hand brakes, automatic couplers, and stake pockets.—Canal Record.

Heavy Freight Trains

By far the heaviest freight train ever hauled by one locomotive on any railroad in this country, and probably in the world, has been moved over the Pennsylvania Railroad between Altoona and Enola, near Harrisburg, Pa. A single locomotive, No. 1113, on June 22, pulled a train of 105 steel cars loaded with 5,544 tons of coal for 127 miles in 7 hours and 12 minutes, or at an average speed of 17.6 miles an hour.

This record movement marks the culmination of a series of tests made for the purpose of determining the hauling power of the most improved types of locomotives used in the regular freight service of the Pennsylvania Railroad over the best grades of the system. That part of the line over which the test was made from Altoona to Enola presents at no point a greater grade than 12 feet to the mile. The latest link in the chain of improvements which resulted in this extreme reduction of grades and removal of curvature was completed and opened to service recently between Mount Union and Ryde.

Locomotive No. 1113, which drew this train, is known technically as the H-8-b type. It was built at the Altoona shops of the Pennsylvania Railroad and has a tractive power of 42,661 pounds. There were more than 105,600 pounds of coal on each car in the train. The total weight of lading was, therefore, over

11,000,000 pounds. The entire train, including engine, caboose and cars, weighed 7,644 tons or 15,288,000 pounds and the coal alone 5,544 tons. The train stretched along the track for 3,600 feet, more than two-thirds of a mile.

The best previous record of a heavy freight movement on the Pennsylvania Railroad was on June 18, when a train of 94 steel cars, loaded with coal, and weighing 13,844,000 pounds, made the run between Altoona and Enola in 7 hours and 31 minutes.

Other runs made during the month of June, which exceeded in train-weight any previous records, were as follows:

Date.	Engine No.	No. of Cars.	Total Weight of Train.	Time. Hrs.	Mins.
June 3	3212	85 Mixed	4852 tons	12	30
June 5	1641	86 Mixed	4922 tons	9	42
June 8	2905	87 Mixed	4623 tons	10	21
June 8	451	75 Steel	5348 tons	10	12
June 8	2903	75 Steel	5348 tons	8	2
June 8	3212	75 Steel	5307 tons	10	21
June 14	1113	85 Steel	6151 tons	7	15

Improvement, Consular Service

For how many years past we know not, the Consular Service of the United States has been more or less a reproach to the country and a matter of humiliation to its citizens traveling or living abroad; do not misunderstand me as stating that this applies to every member of the Consular Service. While there are many able and efficient men in the service, men who are the peers of those in any walk of life, there are also numbers who are unfit to act for our countrymen in any capacity whatsoever. Those numbers are believed to be in the majority, and destined so to be as long as appointment to and retention and promotion in Consular Service are matters of patronage, and not based upon moral integrity, educational requirements and business capacity, and safeguarded by proper civil service rules.

Believing that with an improvement of the Consular Service by certain clear-cut and positive statutory regulations as to prerequisite requirements, tenure of office and promotion, that service could be made a credit to our nation and a profit to its business, and that sentimental and business reasons alike demanded such improvement, The Industrial Club of Chicago has outlined a plan in certain bills introduced into Congress January 23, 1909, for the establishment of a National Consular School, and for placing appointees to the Consular Service upon a civil service basis.

Of the bill for the establishment of the Consular School, an eminent member of the Committee on Foreign Affairs has recently said: "Your bill has already created a great deal of discussion and has, therefore, already helped in the development of public sentiment in favor of a reformation of the Consular Service. * * * Your bill has already accomplished much, in that the novelty of its proposition has created widespread comment upon the necessity of our improving our Consular Service."

So great was the demand for copies of these bills that it became necessary to print a second edition.

In the Consular School, men would be trained to meet on equal ground the commercial rivals of this country in foreign fields, and given that opportunity to perfect themselves for this work, which it is apparent is not now open to them. A university course is not obtainable by the vast majority of young men, or by their parents for them; financial reasons, if no other, intervene.

The Industrial Club hopes, if the necessary legislation should obtain, to open the door of this school to men without regard to their financial condition, and for this reason asks that each student be allowed the sum of $300 per year by the government. Its bill provides, too, so that there may be no unfairness to the government, that the graduate of this school shall remain in Consular Service ten years after receiving his appointment to the service, or to be subject to call for service by the government for five years after graduation.

For war we train soldiers at West Point, and sailors at Annapolis, and what those sailors can do was recently emphasized in the minds not of our countrymen alone, but of all nations, when our fleet made its trip around the world. Why, therefore, should we not train our soldiers of commerce for the warfare of trade, in a governmental school established especially for this purpose?

Dr. James Brown Scott, Solicitor of the State Department, a recognized authority upon consular affairs, in a recent address said: "The expansion of commerce and the search for the world's market require that consuls be able, competent, devoted servants in advance of their selection for the great mission with which they are intrusted at present, and which will be even more important and beneficial in the immediate future. * * * It is for you, gentlemen, and the interests you represent, to see to it that the reform be made permanent; that the inadequacies of the present system, for it is but a first step, be pointed out and corrected, in order that the consular system may become a great and powerful instrumentality in the expansion of American commerce and industry, and that the American product may dominate the markets of the world."

The club hopes to see the day when the irresistible force of public opinion will place the stamp of its approval upon the plans it has so carefully prepared and energetically advocated, and with that approval once obtained it has no doubt as to the result.—Reprint from World's Events, May, 1909.

Utilizing Old Cross Ties

In the work of keeping the tracks of the Panama railroad and of the Isthmian Canal Commission in repair, many hundreds of cross ties no longer suited for use have been thrown aside. These are being collected and will be either condemned and sold or used as fuel by the Commission. It has been the custom heretofore for persons living along the line of the railroad to use them either for fuel, or as supports for houses. The police have been instructed to watch all piles of ties carefully, and arrest any person taking them illegally.—The Canal Record.

The Use of Alternating Currents in Railway Signaling

By W. K. Howe, Chief Engineer, General Railway Signal Co.

I have been requested to write a paper on the use of alternating currents in railway signaling, especially for the benefit of those members of the Railway Signal Association who are just beginning to look into the question.

With this in mind, I have prepared the following more or less elementary paper, realizing that much, if not all, I shall say is familiar to those who have been intimately connected with the subject for the past few years.

The use of alternating currents in railway signaling came into prominence when it became necessary to use track circuits in connection with automatic block signaling on electric roads.

The fact that the rails on an electric road are used to carry back to the power house the relatively enormous currents taken by the train made the ordinary steam road track circuit, with its feeble current and delicate relay, totally untrustworthy because of the fact that the relay would be falsely operated by the traction currents.

It therefore became necessary to employ a relay immune to the influence of the traction currents, and in turn to provide a current capable of operating it.

Alternating current possessing the required characteristics was selected as the signaling current and relays, etc., were designed which could be operated by it and which at the same time would be immune to the traction current.

This was done with the result that alternating current has become the standard power for track circuit purposes on electrified roads, whether the propulsion current be direct or alternating in character. If direct, the signaling current may be of any commercial frequency. If alternating, the signaling current must have a frequency distinctively different from that of the propulsion current.

In addition to its use on electric lines as above described, alternating current has also been employed, and in fact is now being seriously considered for more extensive use on steam roads for track circuit purposes where foreign currents are prevalent.

In this connection it is to be noted that the more densely populated sections of the country are becoming net-worked with electric lines, some employing direct and some alternating current for propulsion, and further that such lines frequently parallel steam roads, and therefore there is a growing tendency for the existence of foreign currents and hence an increasing demand for some effective method of preventing trouble therefrom.

Various methods are being used with more or less effect to render the ordinary direct current steam road track circuit immune to foreign currents, but when their prevalence reaches a point where such methods become questionable, or when it is evident that a system to be installed is likely to be thus affected, it is a question if the wisest policy would not be to "take the bull by the horns" and go at once to the "sure cure" and use alternating currents, especially in view of the incidental benefits to be derived from their use, as will be explained later.

In addition to the use of alternating currents for track circuit purposes on electrified lines, and where foreign currents are prevalent, they may also be employed for the operation of the various signal motors, slots, lights, line relays, indicators,, locks, etc., also for the charging of any batteries which may be used in connection with a given system.

I do not know that I am prepared to recommend the installation of an alternating current system primarily for the operation of the aforesaid devices unless it can be shown to be in the interests of safety reliability and economy of operation, but what I do recommend is that if of necessity an alternating current system must be installed on account of propulsion or foreign currents on the rails, then the same power should also be used for all the devices rather than run one or two more kinds of power the length of the line for the control of operation of the various devices concerned and provide as many sets of generating apparatus, all of which should be in duplicate if used.

The first all alternating current central energy system of this kind was installed on the Electric Zone of the New York Central Railroad, and since then other systems have been installed.

Just as in the first attempt to operate an entire signal from direct current there were many things to be learned from experience, so in introducing a system operated entirely from alternating current, many things have been learned.

Today, however, alternating current systems and devices are available which will operate with as great or, in fact, a greater degree of precision than do those operated by direct current.

For example, in the Hudson's tunnels, with which I am familiar, recent reports show but one automatic signal failure to over 726,000 operations, and on the all-electric interlocking plants which are governed by A. C. track circuits, relays, etc., only one failure in four months, during which time there were over 377,000 operations.

As compared with direct current there are certain added advantages possessed by alternating currents as follows:

(a) Its use for track circuit purposes prevents interference from other currents which may be carried by rails.

(b) It obviates the use of all batteries.

(c) It is extremely flexible, i. e., from a transmission line of given voltage any other voltage or any amount of current desired may be taken by the use of static transformers, which merely consist of some coils of wire, suitably insulated and placed on an iron core, the whole being enclosed in an iron core and mounted upon a pole.

(d) It can be transmitted at a high voltage and small current, thus enabling comparatively large amounts of power to be transmitted great distances with minimum loss.

(e) The high voltages necessary for transmission are kept up on the pole line and are effectively shielded from all working circuits.

(f) More things can be done over a single wire than with direct current.

Alternating currents for signal purposes have, however, certain disadvantages as compared with direct current, as follows:

(a) Alternating current devices consume more energy. This, however, is more than offset by the efficiency of transmission.

(b) Alternating current devices are somewhat more costly, but this is largely compensated for by the reduced number of devices required. For example, few, if any, cut sections are required in track circuits.

(c) Alternating current cannot be directly stored as can be done with direct current in connection with storage batteries.

(d) For its generation rotary apparatus must be kept in continuous motion. This is not a serious matter if, as is frequently true, a source of supply exists for other purposes, and therefore rotary apparatus for the signal system is not required in such cases, nor is it a very serious matter in any case with the present state of development of dynamo electric machinery with their ball bearings, self-lubricating carbon brushes, perfect commutation, insulation, etc. In fact, rotary apparatus has been known by the writer to run for years with practically no attention.

To insure a continuous supply of current in case the primary source should fail temporarily, it is entirely practical to so interconnect a storage battery with the system that the supply of alternating current will continue during such interval.

(e) Owing to the fact that alternating current cannot be commercially stored, as in the case of a direct current storage battery, and that therefore all power must come from the various sub-stations, an alternating current system becomes entirely dependent on the integrity of the transmission line, and this above all other things is the great barrier to its more extensive use on steam roads, except where imperative on account of foreign currents. I say barrier, not because it is impossible to provide a reliable transmission line, nor because of any serious trouble which has been experienced where lines are put up in a substantial manner suitably protected from lightning, and where the sub-stations are so located that if the line breaks energy can be fed up to the break on either side, but because of the expense of such a line, especially where there is no existing pole line on which it may be placed.

As a general rule, the voltage necessary for the economical transmission of power is too high to permit placing the power lines on existing telegraph pole lines unless lead covered or armored cable is used with the sheath grounded at suitable intervals. This, however, is very expensive, although good construction. Neither is it usual to find a high tension transmission line along steam roads that is available for stringing the power wires, so recourse must be had either to a separate pole line or to placing the wires underground.

A separate pole line with bare wires is the least expensive but is subject to the elements, although, as formerly stated, this has not proved a very serious matter for the reasons given above, and also because of the fact that the wire used for transmission purposes would be of much greater tensile strength than the telegraph wires with which you are all familiar. Furthermore, the poles would be relatively short and would not be overloaded with a large number of wires, thereby making the load to be carried excessive in times of sleet storms, etc.

Placing the wires underground is undoubtedly the most reliable of all methods, provided they are suitably insulated and protected from mechanical injury and electrolysis, but this is also a very expensive proposition.

It is, of course, true that dispensing with all batteries, with oil lamps and with practically all cut sections, with the labor and material incidental thereto, makes an important offset to the expense of a reliable power supply and transmission system, yet even taking these things into consideration it is doubtful if such a system could be justified from a commercial standpoint except where imperative on account of safety or where the signaling is reasonably dense, and in any event it is a case of balancing interest charges against operating expenses.

If pole lines exist on which the transmission lines can be placed, or if the power can be taken from some existing source, or if the generating apparatus can be installed where little, if any, extra expenses for attendance will be incurred, or if other uses can be found for the current in addition to that for automatic signaling purposes, such, for example, as charging interlocking storage batteries, lighting towers, stations, etc., then its use, where the signaling is less dense is more likely to be justified.

The above general statements may appeal to you as in a measure unsatisfactory, and I grant you that they are, for a man who wants to know what he shall do in respect thereto, but my experience has shown that most every proposition is different and that no fixed rule can be laid down to tell a man when it is commercially practical to use alternating current signaling on steam roads and when not of course assuming that it is not obligatory on him from the safety standpoint, and therefore the only way to do is to figure it out for each situation, taking all conditions into consideration.

[Mr. Howe then proceeds to discuss the alternating current track circuit as applied to electric traction roads.]

Western Yellow Pine Poles

The western red cedar is largely used on the Pacific Coast for poles. In certain interior parts of California, however, the wood is very expensive, owing to the high cost of rail shipment over the mountains, added to the cost of water transportation from the Puget Sound region to San Francisco. In the San Joaquin Valley, the native yellow pine, obtained from the surrounding mountains, has been used to a limited extent for poles. This tree has a number of qualities which make it a desirable pole timber, but it is not durable, and decays at the butt in a few years when set without being given a preservative treatment.

The Forest Service has recently completed a series of tests in the preservative treatment of this wood. An experimental plant was operated near Fresno, Cal., in which about 600 poles were treated. It was found that the western yellow pine ranks among the woods which are most easily impregnated with preservatives, and that when thoroughly seasoned a penetration of from two to three inches was obtained by immersing the butts of the poles in a tank of hot creosote for a period of 1 hour, followed by 5 minutes' immersion in cold creosote. Owing to the ease with which it absorbs the preservative, western yellow pine is admirably adapted for treatment by the open-tank process. Since the treatments can be conducted with comparatively simple and inexpensive apparatus, it seems certain that the pine pole with creosoted butt will replace the cedar pole in many localities as soon as its advantages are more commonly recognized.

Information on Accidents

It is the policy of the Pennsylvania Railroad System to give to the public, through the newspapers, prompt and accurate information concerning any accidents which may occur on its lines.

Whenever an accident happens, a statement giving all essential facts will be made public by the company at its general offices, in either Philadelphia or Pittsburg, according to whether the wreck is on the Lines East or West of Pittsburg. Such statements will also be given out at offices of division superintendents, where inquiry is likely to be made. Correspondents and editors of newspapers at intermediate points can obtain information by communicating with the nearest superintendent's office or the general offices.

It must be obvious that upon occasions of wrecks it is impracticable for miscellaneous employes to give out information. They have specific duties to perform in caring for the passengers and in re-opening the line to traffic. As their duties are concerned with only certain features of the situation, they are not in position to know the full facts. They are required, however, to report to their superior officers all the facts which may come under their immediate observation. All the information is then assembled and reported to the Company immediately and by the Company made public.

The management of this Company realizes that upon occasions of accident, it is of the greatest importance that the number and names of any who may be injured should be made known immediately. This is all the more urgent as a means of relieving the anxiety of the families and friends of passengers who may be on the train. The Railroad Company is, of course, in the best position to obtain this information, and the newspapers may be assured that the Company will make public such information as it can obtain, freely and fully.

It should be understood that there are many phases of accidents, especially regarding their causes, the facts of which can not be ascertained even by the Railroad Company until after considerable investigation and inquiry. The company will, however, give prompt publicity to all known facts.

The support of the newspapers is necessary in order to secure accuracy in the published reports of accidents. The end to be achieved is so eminently desirable, from the points of view of the public, the press, and the Company, that it is believed that the papers may be relied upon to instruct their representatives to co-operate with the Railroad Company in seeing to it that facts only are printed.

Gamboa Engine House and Yard

An engine house and yard, for the accommodation of Central Division equipment used in hauling spoil from Culebra Cut to the dumps on the relocated line of the Panama railroad north of Gamboa Bridge, have been authorized and the plans have been approved. The location is Gamboa dump, about 1,000 feet east of the center line of the Canal, and 1,000 feet in the same general direction from Gamboa bridge. The new engine house will relieve the congestion at other points.

The building at Gamboa will be 180 feet long and 54 feet wide, and capable of housing 25 locomotives. The type of construction will be similar to the engine sheds at Las Cascadas and Pedro Miguel. The total trackage will amount to 7,660 feet, and will extend over 1,876 feet of the dump. The yard will consist of two repair tracks, with 28-foot centers; four main tracks, one outside and three inside the shed, a coaling track and coal incline. The middle or pit track in the shed will be laid over a pit 180 feet long, while a cinder pit, 40 feet long, will be located under the same track 250 feet away.

The plans also provide for an oil house, 16 by 16 feet, a combined office and storehouse, 11 feet 6 inches by 15 feet 6 inches, a sand house 10 by 20 feet, and a coaling platform 100 feet long, all of wooden construction. The coaling platform will occupy a natural gravity site on the side of a bluff just south of the engine house. It will be 10 feet above the loading track, the right height for easy coaling, and 6 feet below the unloading track, which will be in the form of a switch back up the side of the hill. The sand house will be similarly located.

The water supply will be pumped from water service lines already in operation into a 50,000-gallon tank

connected with a stand-pipe in the yard by a 6-inch pipe. The work of grading and filling in the site of the yard has begun, and the erection of buildings will begin shortly.—Canal Record.

Telephone Poles

Insects play a most important part in timber destruction. The injury done is generally underestimated as their depradations go on gradually, but forcibly, attracting little observation. When they bore into the timber they open up air chambers and channels which make it easy for rainwater to seep in and thus keep the wood in a moist condition. Fungus spores floating through the air are enabled to germinate with greater rapidity and with increased effectiveness and the decomposition of the pole consequently is materially hastened.

Several years ago the Forest Service co-operated with one of the large telephone companies in Georgia and Florida to experiment with various preservatives in protecting the butts of telephone poles from decay. These preservatives were simply painted upon the wood, and of course did not sink in to any great depth. A recent examination made of this pole line showed that wherever the preservative had entered the wood no destruction due to insect attack had taken place, but where the wood was unprotected, such injury was frequently quite serious. Poles in which the preservatives had seeped through a crack were often more or less fluted on the surface, that is, the oil saturating the wood in the immediate vicinity of the crack protected it from the attacks of the insects. It is essential, therefore, particularly in the warmer portions of the United States to protect timber from the attacks of insects as well as of fungi, if the longest life is to be secured.

Trade Notes

Graphite, which is issued as a house organ by Joseph Dixon Crucible Company, contains valuable notes on the uses of graphite and other Dixon products. It is gladly received by many railroad men who have also written the company that the paper contains articles of interest to them.

The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has issued a handsomely printed little booklet describing the applications of its line of small motors to office, store and shop services. The numerous illustrations scattered through the pages suggest many time and labor saving uses for these efficient little power devices; among these are the motor-driven adding machine, mailing machine, eraser, graphophone, envelope sealer, vacuum cleaner, buffing and polishing wheel, blower, sign-flasher, box-covering machine, hand drill, hack saw, coffee grinder, etc.—applications selected at random from the large number of uses where the electric motor provides the ideal power. The booklet, "Westinghouse Electric Motors for the Office, Store and Shop," will be sent on request.

The Detroit Graphite Company, paint makers, Detroit, Mich., has just issued a very complete and attractive booklet, called "The Home of Good Paint," giving a history of their plant from its beginning to the present time, and setting forth how they are equipped to manufacture good paint for various purposes. Any one interested in the purchase of a high class paint will do well to send for one of these.

Technical Publications

WOOD'S WESTINGHOUSE E-T- AIR BRAKE INSTRUCTION POCKET BOOK, by W. W. Wood, air brake instructor. Published by Norman W. Henley Publishing Co., New York. Cloth binding, 5x7 ins., 236 pages, illustrated with color diagrams. Price, $2.00.

This volume gives a very satisfactory explanation of the improved Westinghouse Locomotive Air Brake Equipment, including both the No. 5 and the latest perfected No. 6 style. It will be found serviceable by everyone and of value to those who are already acquainted with this equipment in a practical way.

A series of questions and answers are added, covering what the E-T equipment is, how it should be operated and what to do when defective. All questions that can be asked enginemen for promotion seem to be fully answered.

In the illustrations, the various pressures are shown by different colors so as to assist the reader in understanding the effect produced in the various phases of locomotive and train brake operation.

THE ILLINOIS WATERWAY REPORT, by the Internal Improvement Commission of Illinois, Springfield, Ill. Paper binding, 6x9 ins., 67 pages and also maps.

The report contains the plans and estimates of cost on a waterway by way of the Desplaines and Illinois rivers from Lockport, Ill., to Utica, Ill.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION PROCEEDINGS. Secretary of association, A. L. Woodworth, Lima, O. Cloth binding, 187 pages, 6x9 ins., illustrated.

The proceedings contain reports given at the 1908 convention. A few subjects covered are as follows: Tools and formers, flue welding, case hardening, piece work, thermit welding, etc.

Bulletin No. 30, on the Rate of Formation of Carbon Dioxide in Gas Producers, by Dr. J. K. Clement, L. H. Adams and Dr. C. N. Haskins, has just been issued by the Engineering Experiment Station of the University of Illinois.

The problem attacked by the writers of this bulletin was the determination so far as possible, of the factors that govern the production of carbon dioxide in gas producers. The chemical reaction expressed by the equation

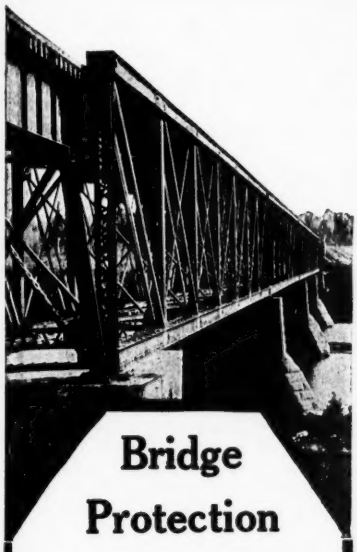
$$C + CO_2 = 2CO$$

which is fundamental in the action of the gas producer, was studied and a differential equation for the reaction-velocity derived. From this equation the velocity constants and the equilibrium constant were calculated from observed values of the percentage of CO formed in given time intervals. The rates of variation of these constants with the temperature were determined, and these were found to agree with VanI't Hoff's laws. From the constants thus determined it becomes possible to calculate the percentage of CO formed for any time of contact of carbon and CO_2 and at any temperature.

In the experiments performed, CO_2 gas was passed through a porcelain tube filled with either charcoal, coal, or coke and heated in an electric furnace. The time of contact could be varied at will and by changing the current a temperature range from 700° to 1300° C. was obtained. Analyses were made by the Hempel method both CO_2 and CO being absorbed.

It was found that the production of CO formed depends upon (1) the temperature, and (2) the time of contact of gas and carbon. With ordinary depth of fuel bed a high percentage of CO requires a high temperature—1300° C. or above.

In an Appendix, Dr. Charles N. Haskins has given a method solving the reaction-velocity equation and has established a criterion for the applicability of the general differential equation to the reaction under investigation. He has also shown that the same general method of solution may be applied to various other types of equations of reaction-velocity.



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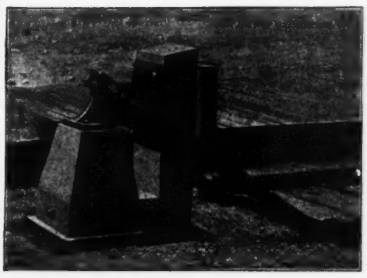

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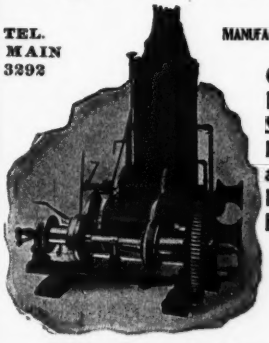

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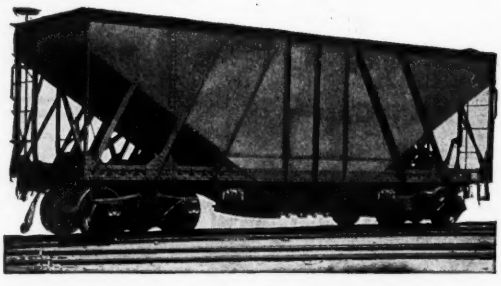

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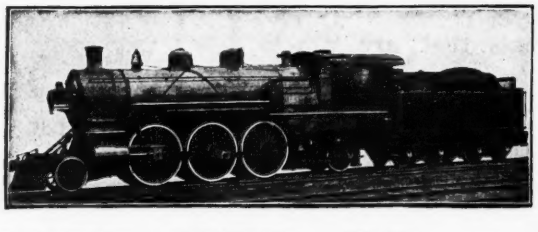

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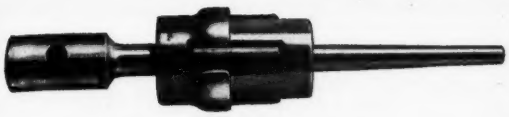

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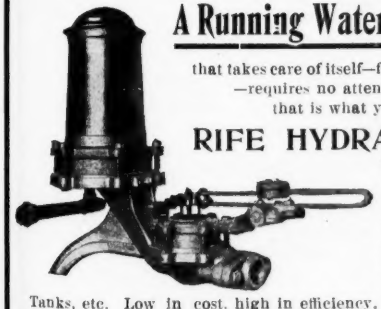

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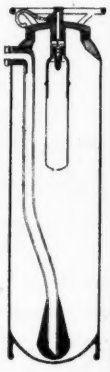

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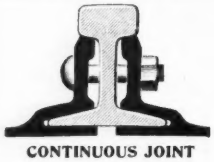

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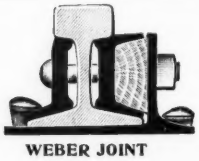

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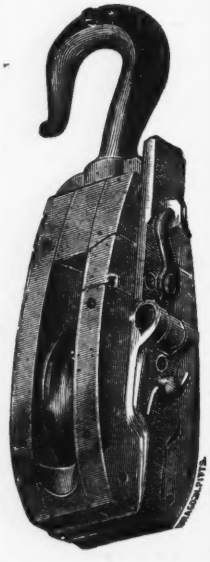

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